

NON-PUBLIC?: N
ACCESSION #: 9101100061
LICENSEE EVENT REPORT (LER)

FACILITY NAME: DIABLO CANYON UNIT 1 PAGE: 1 OF 7

DOCKET NUMBER: 05000275

TITLE: REACTOR TRIP ON TURBINE TRIP DUE TO INADEQUATE
EVALUATION OF
RUNBACK LIMIT SETPOINT
EVENT DATE: 12/05/90 LER #: 90-014-00 REPORT DATE: 01/04/91

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 053

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: MARTIN T. HUG, SENIOR REGULATORY TELEPHONE: (805) 545-4005
COMPLIANCE ENGINEER

COMPONENT FAILURE DESCRIPTION:
CAUSE: A SYSTEM: TB COMPONENT: RLY MANUFACTURER: A109
REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On December 5, 1990, at 2204 PST, with Unit 1 in Mode 1 (Power Operation) at 53 percent power, the unit experienced a reactor trip due to a turbine trip with reactor power greater than 50 percent. A four-hour, non-emergency report was made in accordance with 10 CFR 50.72 (b)(2)(ii) on December 6, 1990, at 0020 PST.

The turbine tripped as a result of a runback initiated by a false indication of a low stator cooling water flow condition. The indicated low stator cooling water flow condition resulted when a flow switch stuck in the low flow position after starting the standby stator cooling water pump. The runback failed to reduce the generator load to below the setpoint of the unit runback check relay, 51RU. This resulted in a generator trip, followed by a turbine trip and subsequent reactor trip.

During the event, circulating water pump 1-2 failed to restart on auto transfer to the start-up bus.

The root cause of the event was determined to be inadequate evaluation of the runback limit for the digital electro-hydraulic controller (DEHC).

The runback limit was not sufficiently low to assure that the turbine would runback to a point below the reset point of the 51RU relay.

Corrective actions for the event include: (1) upgrading the stator cooling water flow switches; (2) initiating a work request to modify the setpoint for the turbine valve position software; (3) issuing a maintenance bulletin; and (4) developing a preventive maintenance test for circulating water pump auto transfer relays.

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END OF ABSTRACT

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I. Plant Conditions

Unit 1 was in Mode 1 (Power Operation) at 53 percent power.

II. Description of Event

A. Event:

On December 5, 1990, at 2200 PST, a plant auxiliary operator began removing main generator stator cooling water pump (TJ)(P) 1-2 from service for routine preventive maintenance. Since pump 1-2 was in operation, stator cooling water pump (TJ)(P) 1-1 was first placed in service. After verifying expected conditions, the control switch for pump 1-2 was placed in the off position.

After placing the switch for pump 1-2 to the off position, the operator observed that flow and pressure conditions were unchanged, and that the pump 1-2 was still running. The operator decided to return the system to the original configuration. The control switch for pump 1-2 was returned to the on position, stator cooling parameters were verified, and the pump 1-1 was shut down.

At 2201 PST, the control room received a stator cooling system alarm, followed by initiation of a main turbine (SB)(TRB) runback (JJ). The runback initiated due to flow switch (TJ) (FS) FS-1 indicating a stator cooling water low flow condition.

Subsequent investigation identified that FS-1 was stuck in the low flow position.

The main turbine runback continued until turbine load was approximately 176 megawatts electric (MWe) and reactor power was approximately 53 percent. At 2204 PST, a unit trip was automatically initiated. The trip occurred because the turbine runback failed to reduce generator load below the setpoint for the unit runback check relay, 51RU. The reactor (AB)(RCT) tripped (JC) due to a turbine trip with reactor power greater than 50 percent.

On December 5, 1990, at 2240 PST, the unit was stabilized in Mode 3 (Hot Standby).

On December 6, 1990, at 0020 PST, a four-hour, non-emergency report was made in accordance with 10 CFR 50.72 (b)(2)(ii).

An action plan (Event Response Plan 90-15) was initiated to investigate the event.

B. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

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C. Dates and Approximate Times for Major Occurrences:

1. December 5, 1990, at 2200 PST: Stator Cooling Water Pump Transfer begins.
2. December 5, 1990, at 2201 PST: Main turbine runback initiated.
3. December 5, 1990, at 2204 PST: Event/Discovery Date - Reactor trip due to turbine trip with reactor power above 50 percent.
4. December 6, 1990, at 0020 PST: A four-hour, non-emergency report was

made in accordance with
10 CFR 50.72(b)(2)(ii).

D. Other Systems or Secondary Functions Affected:

1. Circulating Water Pump (CWP) (KE)(P) 1-2 failed to restart after the 12 kilovolt (Kv) busses had transferred to the start-up power system.
2. Control Rod Drive Mechanism (CRDM) Cooling Fans (CD)(FAN) 1-2 and 1-3 failed to restart following the power transfer.
3. The control room "Trip-Latch" control switch did not indicate that the main feedwater (MFW) pump (SJ)(P) 1-1 had tripped; however, the pump had tripped.
4. The main annunciator typewriter (IB) (TPW) failed due to an overload of the power supply. However, the annunciator windows functioned normally.

E. Method of Discovery:

The event was apparent to licensed operators due to numerous alarms and indications in the control room.

F. Operator Actions:

1. The operators stabilized the plant in Mode 3 using appropriate Emergency Operating Procedures.
2. CRDM Fans 1-2 and 1-3 were reset and restarted to establish the minimum required number of CRDM fans for mode 3.

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3. CWP 1-2 was restarted.

G. Safety System Responses:

1. The main unit generator (EL)(GEN) tripped due to an indicated low stator cooling water flow condition for greater than 135 seconds with generator load greater than the setpoint for the 51RU relay.
2. The main turbine tripped.

3. The reactor trip breakers (AA)(BKR) opened.
4. The control rod drive mechanism (AA)(DRIV) allowed the control rods to drop into the core.
5. The motor driven auxiliary feedwater pumps (BA)(MO)(P) started as designed.

III. Cause of the Event

A. Immediate Cause:

1. The immediate cause for the unit trip was that the turbine runback reduced the generator load to the software setpoint of 176 MWe within the 135 seconds and terminated the runback action. However, due to deadband in the 51RU relay, the relay reset point is equivalent to 158 MWe, and therefore, the unit trip was still enabled after the 135 second interlock elapsed. The runback was initiated because low stator cooling water flow switch FS-1 was stuck in the low flow position.

B. Root Cause:

1. The root cause for the generator stator cooling water low flow turbine runback was that FS-1, a mercoird type switch, actuated on the brief flow disturbance that occurred when stator cooling water pumps were transferred. A brief flow disturbance is normal during stator cooling water pump transfers. A five second time delay exists to prevent a runback from occurring during the flow disturbance. Once actuated, however, the stator cooling water flow switch stuck in the low flow position because the switch cover had been previously damaged by an unknown cause. The switch cover damage resulted in the cover rubbing against the switch, preventing it from resetting from its tripped position.

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2. The root cause for the unit trip is that the 51RU relay, which blocks the unit trip on low stator cooling water flow, failed to reset. The value of the turbine runback low limit software setpoint in relation to the setpoint of

the 51RU relay had not been adequately evaluated. The as-found setpoints are too close together. To provide reasonable assurance that the turbine load will be reduced to allow the 51RU relay to terminate a runback, the chosen software setpoint for the turbine runback low limit must be set far enough below the nominal 15 percent rated stator current setpoint to account for all operating configurations.

3. The root cause for the failure of CWP 1-2 to restart was the failure of restart relay 2VE5B. The relay failed due to improper assembly by PG&E. The improper assembly caused unreliable operation of contacts in the 2VE5B relay, preventing restart of the pump after bus transfer.

Normally, the restart relay is purchased from the vendor assembled. When the unassembled relay was received by maintenance personnel, they did not request a revision to the work package to include any special assembly or testing provisions to assure proper assembly of the relay. The work package used to install the relay included no assembly instructions for the relay.

4. The root cause for CRDM fans 1-2 and 1-3 tripping during the event is unknown. The following investigative actions were taken to identify the root cause:

- a. The fan restart circuitry was examined to identify any abnormalities. No abnormalities were identified.
- b. The fans were restarted and observed. No problems were identified.

Prior to investigating the problem, the breakers for the fans were reset, and the fans started. This may have caused the loss of evidence that would have identified the root cause of the problem. However, it was more important to return the fans to service for plant operation than to preserve evidence of this problem.

5. The annunciator typewriter and its power supply are class II equipment. The failure of the power supply is being investigated in a quality evaluation.

6. The main feedwater pump is class II equipment. Investigation was performed to identify the failure of the

pump trip

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indication. It was determined that the solenoid valve for the trip mechanism did not fully open. As a result, sufficient pressure was removed from the trip mechanism to allow the pump to trip, however, not enough to allow the trip indication to remain lit. The solenoid valve was disassembled. No reason for the valve sticking could be identified. The valve was reassembled, and the trip mechanism was satisfactorily tested several times.

IV. Analysis of the Event

A. Safety Analysis:

A turbine trip with a subsequent reactor trip from 100 percent power is bounded by a previously analyzed condition II event in the Final Safety Analysis Report (FSAR) Update. A reactor trip caused by a turbine trip is a conservative action of the reactor protection system. All safety-related equipment functioned as designed. Therefore, the health and safety of the public were not adversely affected by this event.

V. Corrective Actions

A. Immediate Corrective Actions:

1. The Plant was stabilized in Mode 3 using appropriate Emergency Operating Procedures.
2. CWP 1-2 and CRDM cooling fans 1-2 and 1-3 were restarted.
3. An action plan was developed to investigate the reactor trip and control the return to power.
4. The main annunciator typewriter was reset and all data was retrieved by the I&C Department.
5. The failure of the control room "Trip-Latch" control switch to indicate the main feedwater pump 1-1 had tripped is being investigated.
6. Low stator cooling water flow switch FS-1 was replaced.

B. Corrective Actions to Prevent Recurrence.

1. The stator cooling water instrumentation will be upgraded during the Unit 1 fourth refueling outage. This upgrade includes replacement of the generator stator cooling water flow switches.

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2. A work request will be initiated to modify the DEHC software to assure that a runback will not be stopped prior to the reset point of the 51RU relay.

3. A Maintenance Bulletin will be issued discussing this event and stressing the need for all work performed to remain within the scope of the work package. Additionally, tailboards will be held with the Electrical Maintenance crews discussing the need to have work packages revised if the actual work falls outside the original scope of the work package.

4. A preventive maintenance test will be developed to test the CWP automatic transfer features at least once per each unit refueling outage.

VI. Additional Information

A. Failed Components:

Agastat model number 7012PBL relay failed.

B. Previous LERs:

None.

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James D. Shiffer

Senior Vice President and
General Manager
Nuclear Power Generation

January 4, 1991

PG&E Letter No. DCL-91-002

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Re: Docket No. 50-275, OL-DPR-80
Diablo Canyon Unit 1
Licensee Event Report 1-90-014-00
Reactor Trip on Turbine Trip Due to Inadequate Evaluation of
Runback Limit Setpoint

Gentlemen:

Pursuant to 10 CFR 50.73(a)(2)(iv), PG&E is submitting the enclosed Licensee Event Report (LER) concerning a reactor trip due to a turbine trip with reactor power greater than 50 percent. The turbine trip was caused by a runback that was not terminated due to a low relay setpoint.

This event has in no way affected the health and safety of the public.

Sincerely,

J. D. Shiffer

cc: A. Hodgdon
J. B. Martin
P. J. Morrill
P. P. Narbut
H. Rood
CPUC
Diablo Distribution
INPO

DCO-90-OP-N082

Enclosure

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